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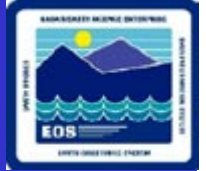
# Generalized Conversion of HDF- EOS Products to GIS Compatible Formats

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Emergent Information Technologies,  
Inc.

February 28, 2002

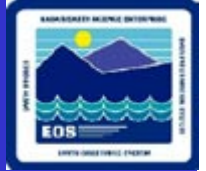
[larry@eos.hitc.com](mailto:larry@eos.hitc.com)



# EOS Data Product Access

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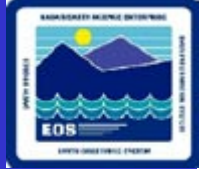
- Standard products are stored and distributed in HDF-EOS format, based on HDF 4.
- The format is self-describing and portable.
- The format was developed to provide a convention for geo-locating data from disparate instruments.
- This allowed product developers to use the same data structures, limiting need to develop access software.
- For example, EOS-AURA instruments will use the same file structure.
- However.....



# EOS Data Access Issues

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- The format did not provide standards in detail.  
For example:
  - Products contain HDF as well as HDF-EOS objects.
  - There are different standards for fill data.
  - MODIS products have little uniformity.
  - Geolocation not uniform – ASTER uses geocentric coordinates and geodetic coordinates
  - Geolocation data in swaths not always available pixel by pixel.



# Challenges for Data Access

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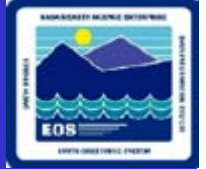
- Demand for EOS data products is extending beyond instrument development teams, eg. GIS users. This implies less storage format expertise.
- GIS applications don't always like HDF-EOS.
- It is desirable to compare ASTER/MODIS/MISR products with the same analysis tools.
- Users may desire area spanning more than a single file. No generalized mosaicing software is available.
- Common commercial tools (e.g. IDL, ENVI) don't accept all EOS products. They accept 'generic' HDF-EOS based products



# EOS Data Converter Requirements

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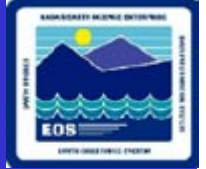
- Convert EOS ASTER, MODIS, MISR to GeoTIFF. Initially, ~50 EOS land products selected.
- Make details of internal file structures transparent to users.
- Convert HDF-EOS Swath to HDF-EOS Grid.
- Allow file selection from users local storage.
- Make functionality available through graphical and command line interfaces.
- Integrate with ECS Data Pool servers



# Data Converter Requirements

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- Functionality
  - Re-projection: USGS, MODIS Integerized Sinusoidal, EASEGrid.
  - Stitching (Mosaicing).
  - Subsetting by band/parameter.
  - Subsetting by geolocation.
  - Metadata preservation/creation.
  - Resampling.



# Data Converter Requirements

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- User Interface
  - Portable, written in C and Java.
  - Initially operable on Sun, SGI, Linux.
  - Not dependent on COTS (eg. IDL).
- Development in Near Future
  - Output Multiple-band GeoTIFFs
  - 4-D data sets (e.g. MOD043)
  - Additional geometric corrections
  - MODIS Ocean/Atmosphere products

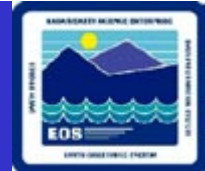


## Re-Use of Tools

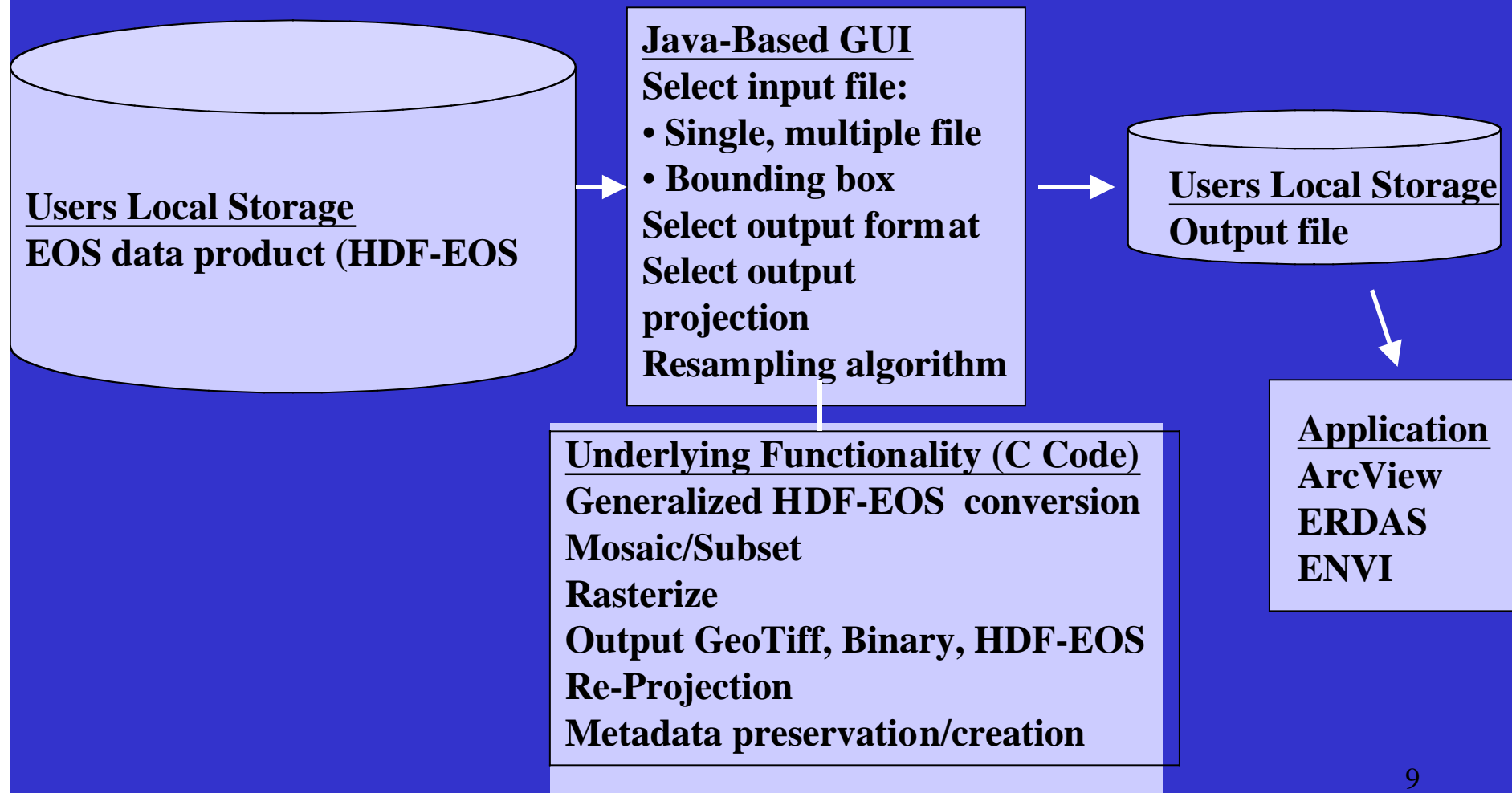
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- Some requirements can be met by modifying and integrating existing tools. For example:
  - HDF-EOS swath/grid format conversion tool prototype from GSFC. This was not adapted to particular products and needed heavy modification.
  - Tools are being developed at EOS archive centers, which are focused on classes of products. For example, the MODIS Reprojection Tool from USGS.
  - Specialized tools, eg. removal of edge effects (MODIS)
- Our approach was to develop what is missing and





# Converter Tool Schematic





# User Interface: Conversion

File Tool Help

<p>Input File: <input type="text"/></p> <p>Objects: <input type="button" value="v"/></p> <p>Fields <span style="float: right;">Selected</span></p> <div><div><input type="text"/></div><div><input type="button" value=""/>&gt;&gt;</div><div><input type="text"/></div><div><input type="button" value=""/>&lt;&lt;</div></div> <p>X Points: <input type="text"/> Y Points: <input type="text"/></p> <p>Band: <input type="text"/> Save HDF? <input type="radio"/> Yes <input type="radio"/> No</p> <p>Spatial Subset: <input type="button" value="v"/> Lat-Long</p> <table border="1"><thead><tr><th></th><th>Latitude</th><th>Longitude</th></tr></thead><tbody><tr><td>UL Corner:</td><td><input type="text"/></td><td><input type="text"/></td></tr><tr><td>LR Corner:</td><td><input type="text"/></td><td><input type="text"/></td></tr></tbody></table>			Latitude	Longitude	UL Corner:	<input type="text"/>	<input type="text"/>	LR Corner:	<input type="text"/>	<input type="text"/>	<p>Object Info:</p> <div><input type="text"/></div> <p>Output File Name:</p> <div><input type="text"/> <input type="button" value="Browse..."/></div> <p>Output File Type: <input type="button" value="v"/> GeoTIFF</p> <p>Resampling Type: <input type="button" value="v"/> Bilinear</p> <p>Output Projection</p> <div><input type="button" value="v"/> Geographic</div> <p><input type="button" value="Edit Parameters"/></p> <p>Pixel Size X: <input type="text"/> Y: <input type="text"/></p> <div><input type="button" value="Accept"/></div>	<p>Accepted List</p> <div><input type="text"/></div> <div><input type="button" value="Remove"/> <input type="button" value="Save"/> <input type="button" value="Clear"/></div> <div><input type="button" value="Run"/></div>
	Latitude	Longitude										
UL Corner:	<input type="text"/>	<input type="text"/>										
LR Corner:	<input type="text"/>	<input type="text"/>										

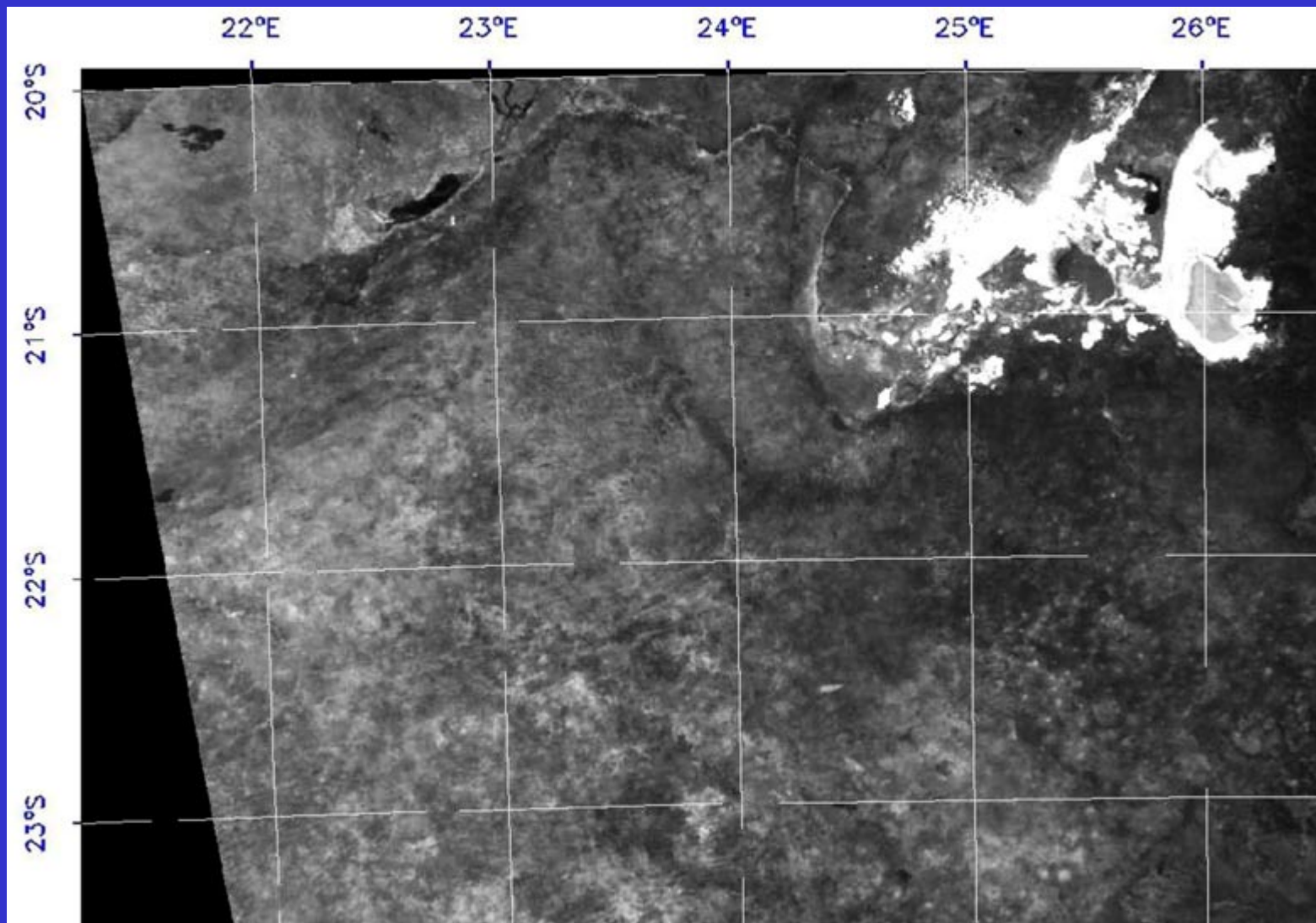


# User Interface: Stitch/Subset

File Tool Help		
Input Files:		Object Info:
<div></div>		<div></div>
Objects: <div></div>	Output File Name:	
Fields	Selected	<div></div> <div>Browse...</div>
<div></div>	<div>&gt;&gt;</div>	Output Object Name:
	<div>&lt;&lt;</div>	<div></div>
Band Number: <div></div>	Output File Type: <div>Hdf-Eos</div>	
	X Pixel Size: <div></div>	
	Y Pixel Size: <div></div>	
	Save Stitched File? <input type="radio"/> Yes <input type="radio"/> No	
UL Corner: <div></div>	Latitude	Longitude
LR Corner: <div></div>	<div></div>	<div></div>
	<div>Accept</div>	<div>Run</div>



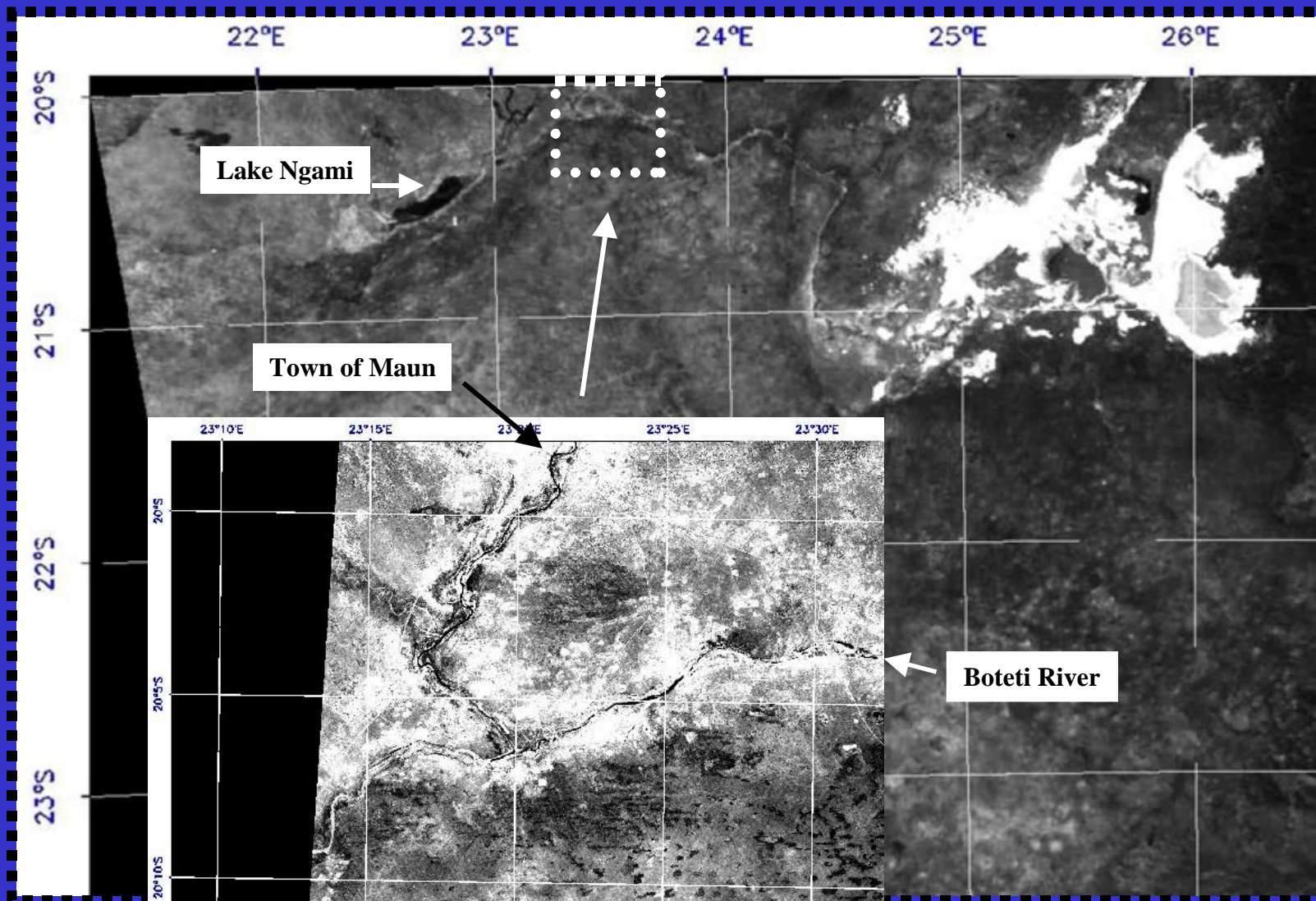
# MODIS L2 Surface Reflectance: Safari 2000





# MODIS L2/ASTER L1B Surface Reflectances

## Safari 2000 Campaign - NW Botswana



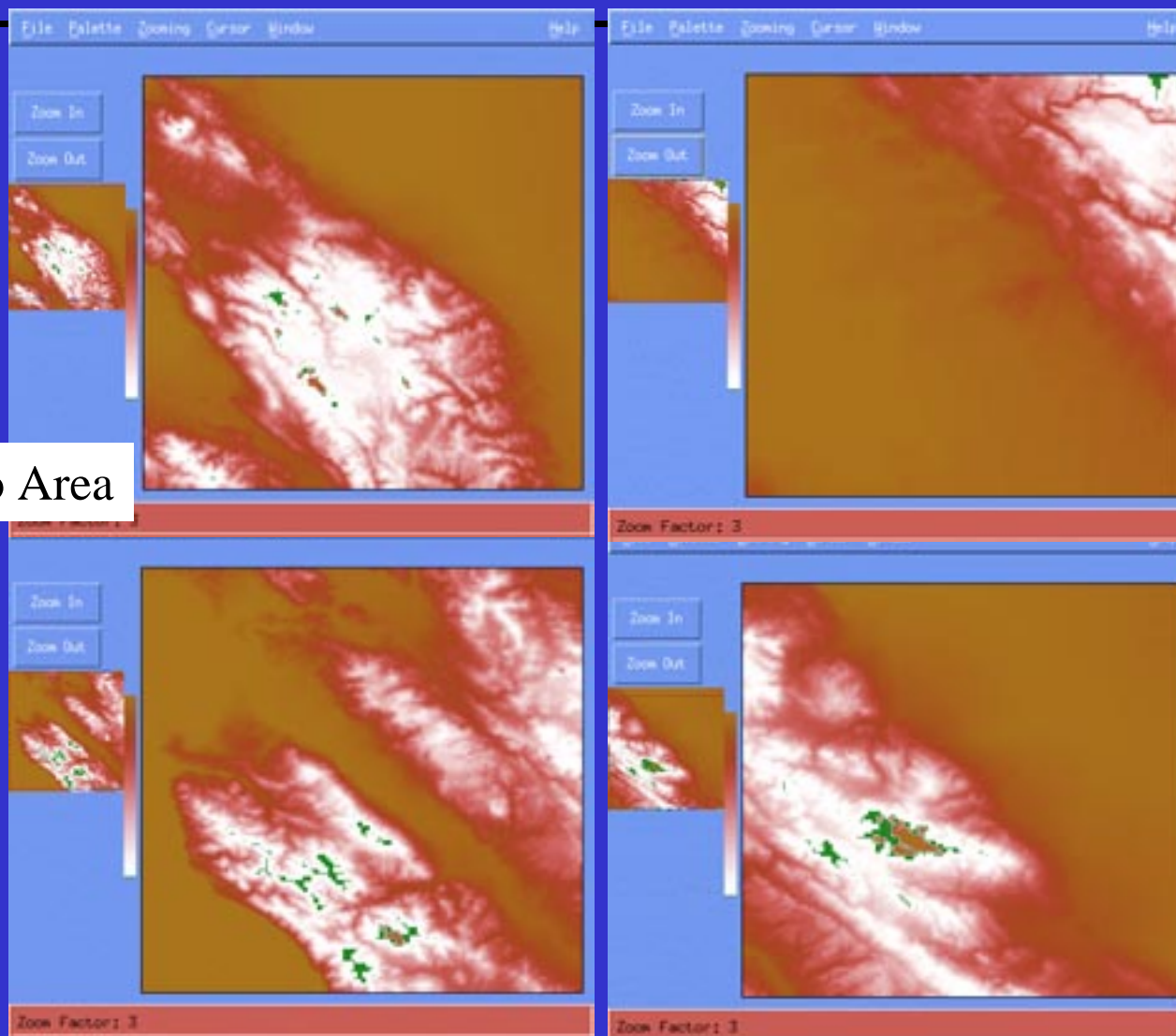


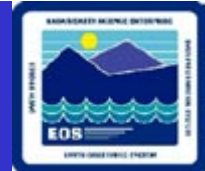


# One km. Digital Terrain Data

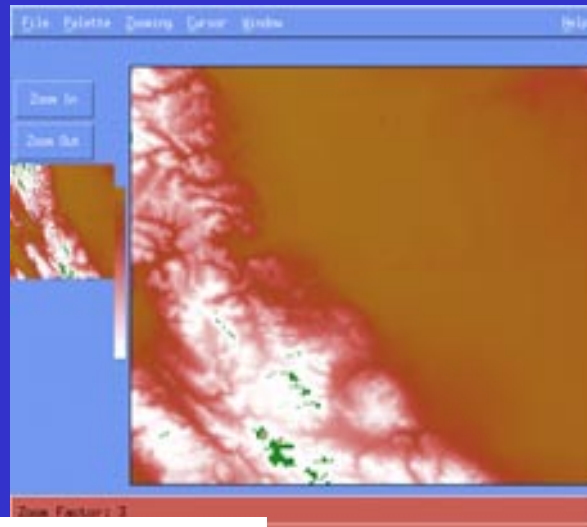
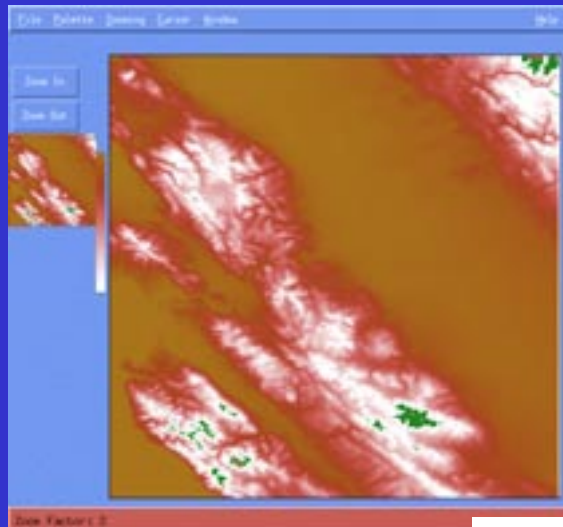
HDF-EOS  
Grid Files

San Fransisco Area



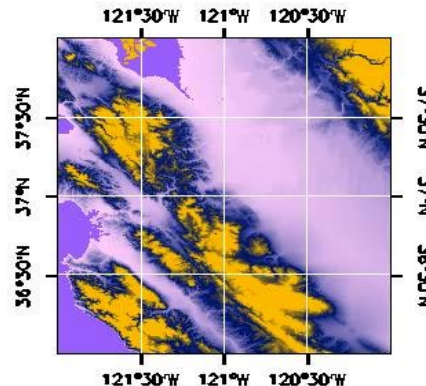


# One km. Digital Terrain Data



Subsetting

Four Tiles  
Stitched

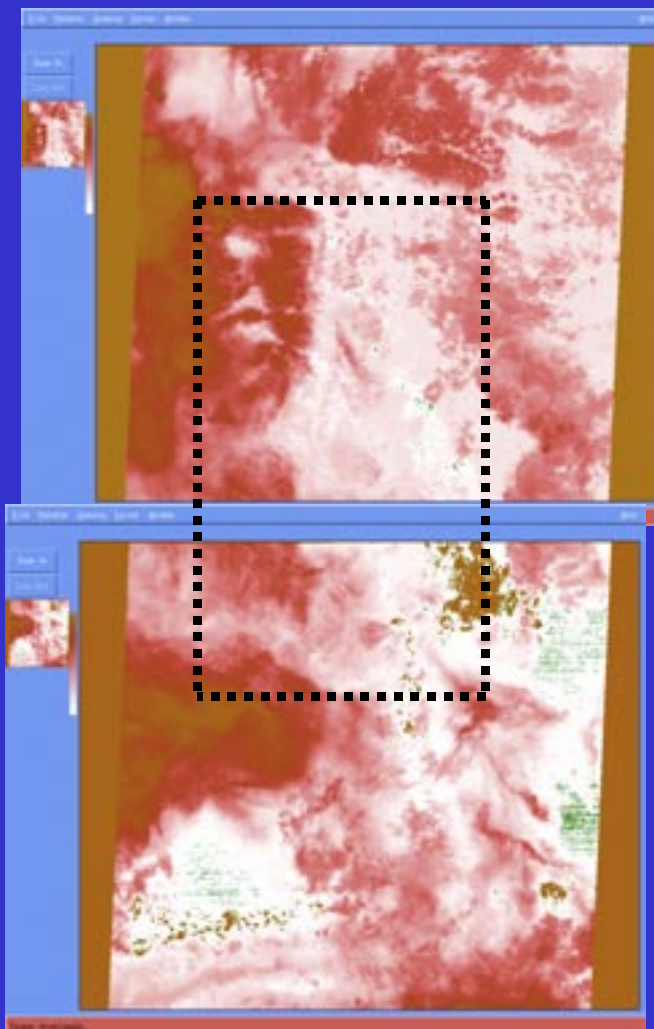


GeoTIFF File

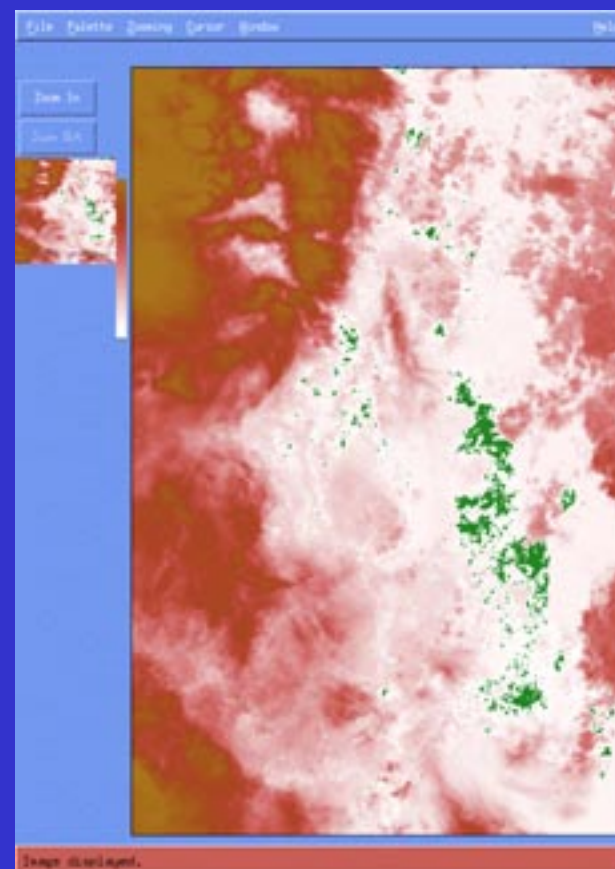


# ASTER Swath Stitching/Subsetting

Swath  
Files



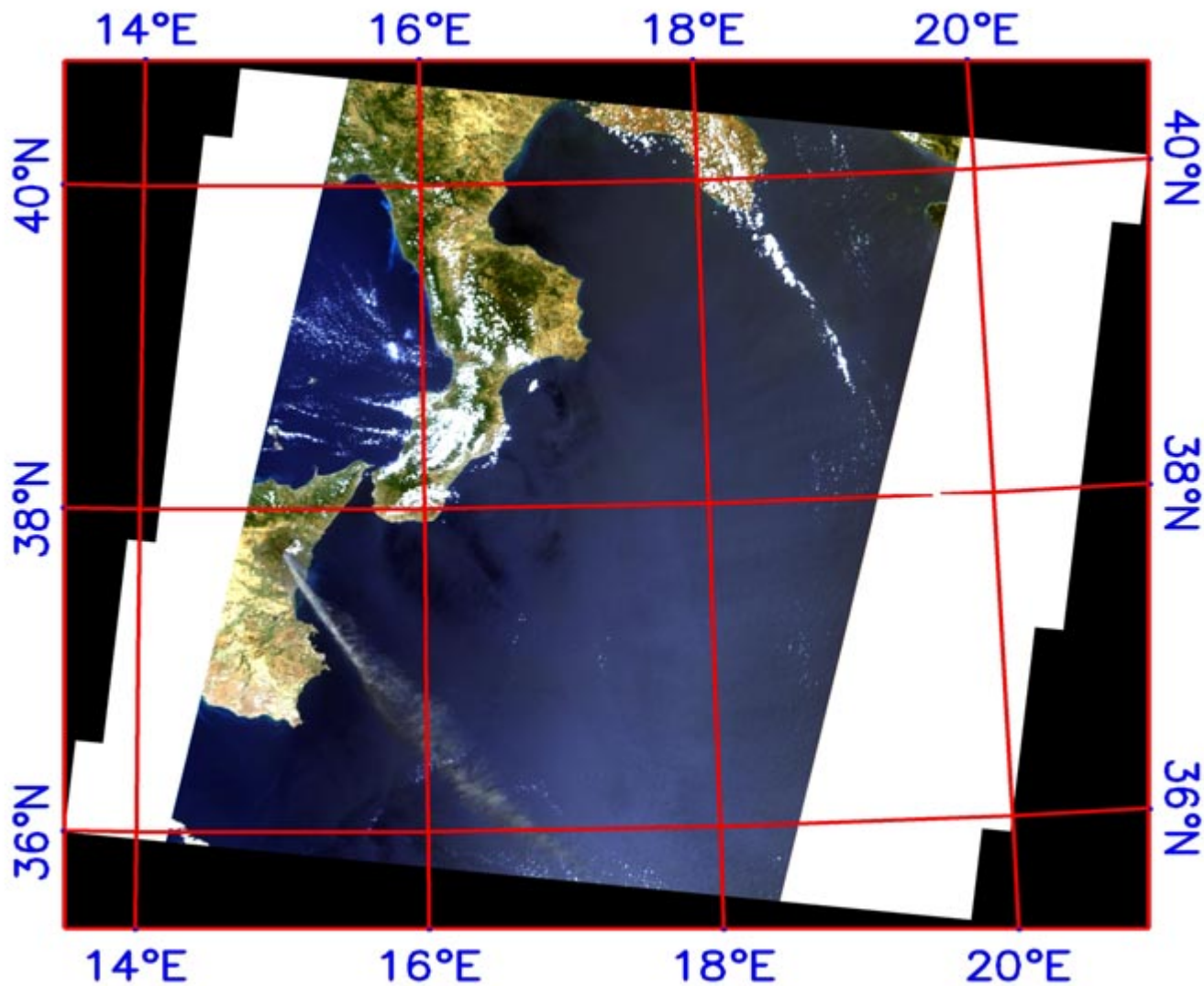
Grid  
File

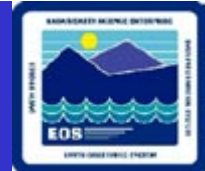






# MISR L1B Mt. Etna Eruption





# ASTER L1B Mt. Etna - Stitched

